INFORMATION TECHNOLOGY AND URBAN FORM
New Wine in Old Bottles—Rejoinder to John P. Frendreis

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ABSTRACT: *The forecast—that technological change in communications and information technology will have little effect on urban form—is subject to challenge on several fronts. This comment develops three counterarguments, concluding that traditional conceptions of urban form blind us to significant roles that communications and information technology might play in shaping the character and experience of urban life. This article is a rejoinder to John P. Frendreis' "The Information Revolution and Urban Life.*

The information revolution has been the subject of a great deal of utopian and dystopian speculation over the last decade. Urbanists, including social scientists, architects, and urban planners, have not been immune to the idea that technological change could be a major driving force behind social change, particularly with respect to urban form. In fact, some have capitalized on being among a vanguard that understand the design of the new "information city." To such speculation, "The Information Revolution and Urban Life" serves as a useful antedote. John Frendreis's down-to-earth synthesis of theory and research contributes to a growing body of opinion, backed by empirical research, that the implications of information technology on urban form are less deterministic and more contradictory than suggested by many popular accounts.

That said, I nevertheless find it difficult to accept the thrust of his claim that "telematics" will have a "greater effect on how people spend their time than where they spend it." The point marginalizes the role of technological change. There is no doubt that the telephone, television, and newer communication and information technologies have been used in

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ways that have significant implications for how we spend our time (Dutton, Rogers, & Jun, 1987). Likewise, there is substantial support for the thesis that information technology has not contributed uniformly to the decentralization of urban populations (Pool, 1977). Neither the telephone or newer information technologies can be said to have caused urban sprawl and they are unlikely, indeed, to create some new urban form that does not entail the "concentration of population in urban areas" in Frendreis' words. There are some countervailing forecasts, discussed by Robert Warren in his rejoinder. However, Frendreis' general argument is consistent with the thrust of other work, including a series of studies focused on the telephone reported on in an edited collection by Pool (1977) and several overviews of research on information technology, particularly those by Anthony Downs (1985), Kenneth Kraemer (1982), Kraemer and King (1982), and Patricia Mokhtarian (1988, 1989).

Frendreis may have set up a straw man by challenging an overly deterministic notion of the impact of technological change on urban decentralization. The focus on decentralization of urban populations overlooks the consequences of technology in reinforcing prevailing values and interests. Also, the analysis fails to consider a multitude of more subtle ways in which urban form, even as traditionally conceived, has been shaped by change in the technology of design and urban planning rather than simply in communications. Finally, his conception of urban form is anchored in a traditional perspective, tied to transportation and land use planning, that focuses on the distribution of buildings and jobs to the virtual exclusion of the content and distribution of information resources and services as new cable and telecommunications infrastructures. The following sections focus on each of these issues in turn to argue that technological change in communications and information technology may be more central to urban life than Frendreis concludes.

REINFORCEMENT OF PREVAILING VALUES AND INTERESTS

In the 1960s, many urbanists viewed urban sprawl in the United States as in part a product of technological change in transportation, primarily tying it to the development of freeways. However, they often assigned some blame to the telephone. According to this argument, the development of improved means of electronic communications permitted the decentralization of urban areas. Early research on the impact of the telephone on metropolitan development tended to undermine this thesis, suggesting that the telephone had "dual" effects, reinforcing centralization as well as decentralization. (Pool, 1977, pp. 299–369, provides an excellent sample of the early literature on the impact of the telephone on metropolitan development.) Frendreis has extended this contradictory effects argument to "telematics," or what I would refer to as information technology. I use this term to refer quite broadly to the convergence of computing, telecommunications, and management science techniques. The term telematics is used by the French in the broadest sense. However, Americans often use this term in a narrower sense to refer to so-called new information services such as videotex, while excluding more traditional electronic media such as plain ordinary telephone services. Since advances in information technology are blurring any boundaries among once separate technologies, it does not seem useful to focus on a limited range of services that have yet to be widely diffused.

Unfortunately, the notion that technology has contradictory effects can too easily lapse into a conclusion that it has either no effect or that it is neutral. A more tenable conclusion might be that communications and information technologies are malleable and capable of facilitating a variety of ends or objectives. The idea that telecommunications facilitate the accomplishment of locational decisions decided on other grounds, rather than determine them, has been advanced by Downs (1985), Moss (1987), and others. They might be used to centralize or decentralize organizations, for example. The newer information technologies represented by the convergence of microcomputing, telecommunications, and management science techniques might well be more malleable than earlier generations of computing and telecommunication technologies, which were more compatible with centralized management structures. An empirical study of power shifts associated with computing in American local governments concluded that information technology is selectively adopted and utilized in ways that serve "the interests of those who control" the organization, thereby tending to reinforce "the prevailing interests and values of the organization" (Danziger, Dutton, Kling, & Kraemer, 1982, p. 231). Similarly, in the larger urban area, computing and telecommunication technologies are likely to be malleable and facilitate rather than constrain decisions so that they may be made on other grounds, such as the availability of transportation, the value of land, restrictions on zoning, the need for face-to-face communications, or the availability of labor. If this facilitative or reinforcement effect is valid, it poses a dramatic impact indeed, even if it is not systematically biased to promote centralization or decentralization. Put simply, information technology is neither neutral nor ineffectual if it is used in ways that reinforce the values and interests of those who control locational decisions.

Telecommuting provides a useful example. Early proponents of telecommuting viewed telecommunications as an increasingly viable substitute for transportation. More people could work at home or at more decentralized locations rather than commute to the central business district of major metropolitan areas (Nilles, Hanneman, & Gray, 1976). The most optimistic of these proponents of telecommuting were addressing social issues of the late 1960s and early 1970s, when air pollution and energy conservation were high on the national policy agenda. Telecommunications was identified as a technological fix. Since advances in communications and information technology made the location of information work increasingly less dependent on where information was stored, so the reasoning went, telecommunications might be substituted for travel, reducing travel and energy use (Dickson & Bowers, 1974). Empirical research failed to identify appreciable decreases in travel or energy use as a consequence of telecommunications substitution (Kraemer, 1982; Kraemer & King, 1982).

Frendreis and others have interpreted the slow take-up of this telecommuting option as evidence that technological change will not have dramatic effects on urban form. However, the telecommuting literature was never anchored in a technologically deterministic perspective. Instead, its proponents accepted what has now become the accepted wisdom, which is that information technology could facilitate locational decisions made for other reasons. The negative findings do not necessarily undermine this assumption. Telecommunication could and does on occasion find value in facilitating telecommuting. However, most managers do not perceive their organization's values and interests to be well served by telecommuting options that weaken management control over employees. Therefore,

managerial strategies in the public and private sectors have not been supportive of such options. Perhaps early forecasts proved to be optimistic because they overestimated the degree to which business, governments, and the public could be marshalled to support the interests and values of the promoters of telecommuting.

In contrast, when centralization or decentralization has served the interest of business and industry, there is strong evidence that information technology has been used to facilitate such shifts. Banks and other financial institutions have been able to locate some of their clerical operations outside of the central business districts to less expensive locations that are more accessible to suburban labor pools (Moss, 1987). These same institutions have centralized many information processing tasks, such as credit card billing and accounting, for which there are major economies of scale owing to the use of information technology. Manufacturers based in the United States, for example, have moved labor intensive aspects of their operations to developing nations (e.g., Warren's rejoinder). That is, examples abound were information technology has facilitated change in the location of business and industry that affect urban form within and among regions, even as traditionally defined, but in ways that are more complex than captured by old notions of centralization v. decentralization or urban sprawl.

TECHNOLOGY OF URBAN DESIGN, ARCHITECTURE, AND PLANNING

John Frendreis' discussion of telematics and urban form, like that of other urbanists, views consequences flowing from how residents and businesses choose to use information technology primarily to support communications. Computing and telecommunications are also changing the way in which architects and urban planners, for example, do their work. Might these technological changes have indirect but important implications for urban form?

Most directly, the design of spaces within homes and office buildings has been affected by the increasing presence of information technology. The adoption of personal computing has already begun to influence the design of modern desks, studies, and work stations in the household and office. Some discussions of so-called smart homes, intelligent buildings and smart parks undoubtedly exaggerate the functionality of information technology. For example, some so-called intelligent buildings entail little more than the wiring and equipment, such as a private branch exchange, for tenants to share telecommunication facilities (Downs, 1985). Developments that incorporate functions beyond telecommunications, such as security and fire alarm systems as well as metering and energy management systems, are already in place in Japan, the United States, and Western Europe. These technologies are being designed into new structures, directly changing the character and functionality of urban spaces, albeit incrementally and in subtle ways.

Traffic engineers have employed information technology in new tools to assist transportation planning and control. Engineers can employ information technology to manage traffic flow, such as with traffic signal control systems and electronic bulletin boards that pass messages to motorists on the freeways. Despite the fact that telecommunications has not commonly been substituted for travel within metropolitan areas, transportation planners are actively using information technology to affect transportation patterns. Telecommuting programs mentioned previously are being introduced by state and local government agencies as well as businesses as a means for distributing business centers and reducing peak hour traffic on major freeways.

For example, the Southern California Association of Governments (SCAG) has introduced a pilot telecommuting program and also incorporated telecommuting objectives in many of its planning documents (Mokhtarian, 1988). Interestingly, SCAG hopes to promote telecommuting as a means to support development of a more multinucleic urban form, in which people commute from everywhere to everywhere rather than from the suburbs to the central business district. Frendreis concludes his paper arguing that there "will likely not be a new urban form . . . unless people choose to characterize the automobile-based multinucleic form in this way." This is exactly what one major regional planning agency has done.

These and other technological innovations can make incremental differences in traffic flow that might well affect the capacity of urban areas, commute times, and distances, which together can influence urban form.

Urban architects and planners are also employing information technology to assist them in ways that might have implications for the design of urban areas. Architects already use computer-aided drafting and design (McCain, 1989). Soon they may use interactive video disc technology to simulate alternative urban designs, moving beyond what can be done with physical models. Michael Joroff and others at the Massachusetts Institute of Technology have developed interactive video disc simulations of urban areas that illustrate its potential as a planning tool. Computer-based systems are even employed to construct more sophisticated physical models which can more closely approximate the detail of planned developments (Browning, 1989). Conceivably, decisionmakers might see what their city, neighborhood, street, or home might look like, given alternative design decisions. Once decisions are made, developers can use such models and simulations for computer walk-throughs to confirm the choice and help sell designs to relevant publics (McCain, 1989). In some respects, these technologies simply extend what has been done with physical models and drawings. The development of the information technology to support these applications might permit the more frequent and economical use of some models, increase the cost but also the persuasiveness of other models, and facilitate the process of refining and revising designs. There development might also permit more choice and discretion to shift toward clients who can visualize a wider range of alternatives than they were likely to be presented by an architect or planner working with physical and sometimes less malleable models.

Less concretely, technological change has offered a variety of new design metaphors, which are already influencing the perspectives of architects and urban planners. In Japan, an international group joined a competition to influence the design of an advanced information city. (Droege, 1988b). If the design community and their clients try to imagine new urban forms that somehow respond to their image of the future, they will. And it does seem that the idea of designing spaces to adapt to the information age is becoming more prominent within the planning literature (Droege, 1988a). In part, this reflects an effort of architects and planners to wrap their old designs in new clothes. But not always. As architects and planners design spaces that respond to their notions of the information age, these new design metaphors, mediated by different cultural and economic contexts, will undoubtedly affect urban form in as yet unpredictable ways. Just as the design of critical features of Los Angeles, such as the Miracle Mile, were influenced by the age of the automobile, other cities might be designed around new capabilities or constraints presumed to accompany information technology.

DEFINITION OF URBAN FORM IN AN INFORMATION AGE

When I arrived in Kawasaki, Japan, in the summer of 1988, I could not see any obvious evidence of what I had understood to be a major urban redevelopment program. It looked much the same as I remembered from my last visit to the city, several years prior. I was simply looking in the wrong place. A major new development was literally under my feet in the form of an extensive underground shopping mall. I was looking in the same old places for the familiar forms of urban redevelopment.

I think there is an analogy to this problem in Frendreis' observations. Most discussions of the impacts of technological change on urban form are anchored in traditional notions of the urban community, which are tied to the physical location of people, households, and other urban structures. Louis Wirth (1938) was undoubtedly correct—size, density, and heterogeneity are key attributes defining the character of urban life. They are not the only attributes. His perspective from the 1930s might well be too limited a view on urban life in the 1990s. Why should we not regard telephone, cable, satellite, and other communication infrastructures and services as analogous to transportation infrastructures and services? Why should transportation and land use be considered almost to the exclusion of new communication infrastructures and the use of information resources in characterizing urban form?

Information technologies can and have been viewed as infrastructures that electronically connect communities in ways that can be quite different from the transportation infrastructures that physically connect communities. We have long known that the boundaries of political jurisdictions seldom conform to the boundaries of social and economic communities. Likewise, communications and information technologies can reinforce or undermine the local community. In the 1960s and 1970s, proponents of the "wired city" saw local and interactive cable television systems as a means for communications to support the local geographical community (Dutton, Blumler, & Kraemer, 1987). Of course, the emergence instead of satellite-linked cable TV networks has undermined the notion of a wired city and made local affairs an even more problematic component of cable services.

Urbanists interested in the role of technological change on urban life might wonder whether urban communities can see news about their local community on television. They should be as interested in how the psychological community of individuals might be changing in ways that might diminish the relevance of their geographical community. Likewise, just as urbanists are concerned if an urban neighborhood is isolated by the design of a freeway system, as much of the community of Watts had been in Los Angeles, so might they be concerned if these areas are not linked to major systems of mass communications, such as cable television. These are but a few examples of issues concerning urban life that are tied to the development of communications and information technology. If we wish to look for the impacts of information technology, maybe urbanists should look more closely at issues that are most directly related to the technology.

CONCLUSION

I would hesitate to put new wine into old bottles. Urban form, at least as it is traditionally defined, does not capture aspects of urban life that are most closely tied to advances in

communications and information technology. In less Biblical terms, if you want to hunt ducks, you had best go where the ducks are. If Frendreis judges information technology to be largely irrelevant to urban form, it is partly because he is looking in the wrong place.

Those interested in technology and urban life might look at the use of communications and information technologies by households and businesses from perspectives that are less limiting than traditional definitions of urban form. It affects, to paraphrase Harold Lasswell's classic definition of communications, who people communicate with, about what, and over what channels. As Frendreis notes, information technology is affecting how people spend their time. This is important to recognize. In addition, information technology has affected where people are located. It has changed the way planners and architects do their work, in addition to providing them with new metaphors to guide their designs. Also, it has not only changed the way people communicate over distances, but also the content and flow of communications, which affect our psychological and physical community in ways that are less deterministic, more differentiated by social and political factors, and more contradictory than early forecasts led us to expect.

Finally, the influence and effects of information technology cannot be dismissed by defeating a strawman. Over a decade ago, technologically deterministic views of the impact of the telephone on metropolitan growth were set aside. Nevertheless, I have argued that the telephone and newer information technologies diminish constraints on locational decisions, make new options available to decisionmakers and, thereby, facilitate changes driven by other values and interests. In this way, information technology is indeed tied to the evolutionary changes taking place in urban areas, even in the sense in which urban form can be traditionally defined.

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